Space Weather Technical Forecast

Issued on Sunday, 30 January 2022 at 00:29 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Slight chance G1/Minor Geomagnetic Storm day 1 (30th). Chance of further Moderate flares/R1-R2 Radio Blackouts.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Moderate through the last 24 hours, also with frequent C-class flare activity. Most of the flares originated from the large sunspot group AR2936 (Ekc/Beta-Gamma) in the northeast quadrant, approaching centre disc, and also an active region just beyond the southeast limb. The largest flare observed was a M1 from AR2936, just prior to this issue.

There are currently three other numbered sunspot regions on the visible disc. AR2934 (Hsx/Alpha) in the southwest remains unchanged. AR2937 has now decayed. AR2935 (Bxo/Beta) in the northwest has seen some weak growth in its leading spots. AR2938 (Axx/Alpha) in the northeast has shown some very weak small spot re-emergence.

No Earth-directed CMEs have been observed.

Solar Wind / Geomagnetic Activity: The solar wind, as observed at L1 has risen slowly from 450km/s to 550km/s. The density was predominantly at average to occasionally just above average levels. The total field strength (IMF) Bt, was mostly weak between 4-9nT, with a slow downward trend. The north-south component, Bz, remained weak and variable ranging between +6nT and -7nT, although becoming mainly positive after midday UTC. Phi angle was generally positive (away from the Sun), but with some brief negative fluctuations. Geomagnetic Activity was Unsettled to Active (Kp 3-4) between 29/0000-1500UTC, becoming Quiet (Kp 1) thereafter.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) measured at GOES 16 was at background levels. The high energy electron flux (greater than 2MeV), was at background to moderate levels, peaking at 506 pfu at 29/1415 UTC. The associated electron fluence was below the Active threshold (1e8 integrated flux), with 1.13e7 recorded at 30/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low solar activity is expected through the period, with a chance of further isolated M-class flares, and a slight chance of X-class flares. These again most likely from AR2936, and an active region approaching the southeast limb.

Solar Wind / Geomagnetic Activity: A CME from 26 Jan could just give a weak Earth-directed glance on day 1 (30 Jan), although confidence is low. Otherwise, elevated solar winds at first on day 1 (30th) are likely to gradually trend lower to slightly elevated levels for much of the rest of the period, as the current high speed stream influence wanes. A further slight enhancement is possible from later on day 3 (01 Feb) from coronal hole 48.

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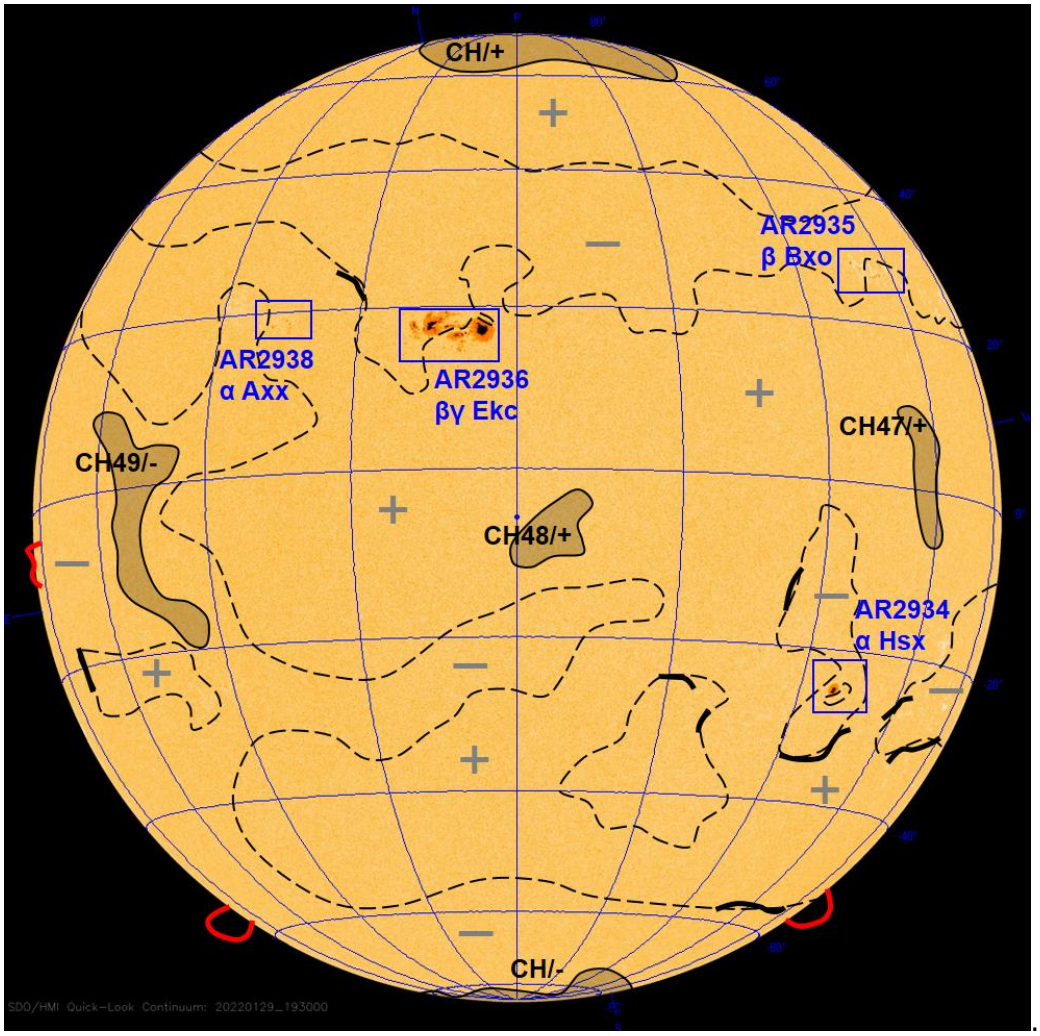
Met Office Space Weather Technical Forecast

Geomagnetic activity is expected to be Quiet to Unsettled (Kp 1-3) with a chance of isolated Active intervals (Kp 4) and a slight chance of G1/Minor Storm (Kp 5) intervals on day 1 (30th Jan). Thereafter, becoming generally Quiet to Unsettled, perhaps with a chance of isolated Active intervals from later day 3 (01 Feb).

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux is forecast to to most likely remain at background levels, however probabilities increase slightly through the period as AR2936 transits west. The high energy electron flux (greater than 2MeV) is expected to remain at predominantly background to moderate levels, but with an increasing chance of high levels being reached at the peak of the diurnal cycles, especially during days 3 and 4 (01 and 02 Feb). The associated 24hr fluence is expected to remain below the Active threshold, despite an increasing trend.

Figure 1. Solar Analysis Valid 29/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

A filament eruption at 26/1945 UTC, from near AR2934 generated a CME which could just give a weak Earth-directed glance on day 1 (30 Jan), although confidence is low.
Otherwise, elevated solar winds at first on day 1 (30th) are likely to gradually trend lower to slightly elevated levels for much of the rest of the period, as the current high speed stream influence wanes. A further slight enhancement is possible from later on day 3 (01 Feb) from coronal hole 48.

Geomagnetic activity is expected to be Quiet to Unsettled (Kp 1-3) with a chance of isolated Active intervals (Kp 4) and a slight chance of G1/Minor Storm (Kp 5) intervals on day 1 (30th Jan). Thereafter, becoming generally Quiet to Unsettled, perhaps with a chance of isolated Active intervals from later day 3 (01 Feb).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	15	5	10	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
27/0501	Partial	Filament	S23 W012	411	30/1200 UTC	Low confidence of any impacts.

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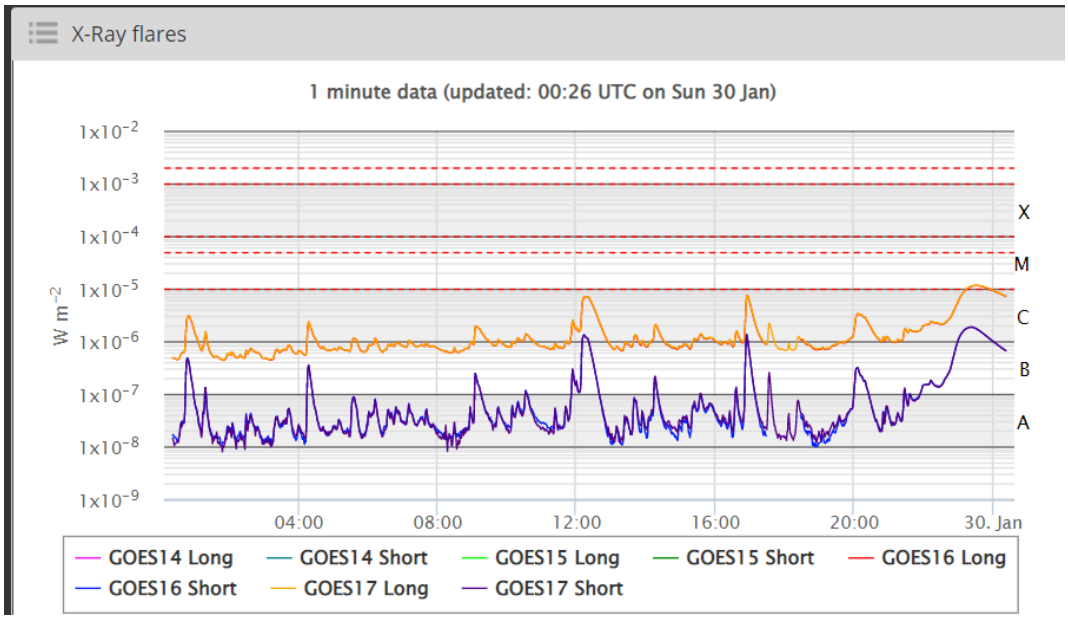
Radio Blackouts - X-Ray Flares:

Solar activity has been Moderate through the last 24 hours, also with frequent C-class flare activity. Most of the flares originated from AR2936 in the northeast quadrant, approaching centre disc, and also an active region just beyond the southeast limb. The largest flare observed was a M1 from AR2936, just prior to this issue.

There are currently four numbered sunspot regions on the visible disc. AR2936 remains the largest and most complex (Ekc/Beta-Gamma), with a continued increase in development in the intermediate spots. AR2934 (Hsx/Alpha) in the southwest remains unchanged. AR2937 has now decayed. AR2935 (Bxo/Beta) in the northwest has seen some weak growth in its leading spots. AR2938 (Axx/Alpha) in the northeast has shown some very weak small spot re-emergence. Low solar activity is expected through the period, with a chance of further isolated M-class flares, and a slight chance of X-class flares.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	40	40	40	40
Very Active	R3 to R5 X Class	No	10	10	10	10

Figure 2: GOES X-ray flux.



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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux, as measured by GOES-16 is at background levels. No solar radiation storms are likely in the period, however probabilities increase slightly through the period as AR2936 transits west.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	2	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2MeV) as observed by GOES-16 at GEO, was at background to moderate levels, peaking at 506 pfu at 29/1415 UTC. The high energy electron flux is expected to remain at predominantly background to moderate levels, but with an increasing chance of high levels being reached at the peak of the diurnal cycles, especially towards the end of the four day period.

With only a limited flux response anticipated from either fast wind enhancement, the associated 24hr fluence is expected to remain below the Active (1e8 integrated pfu) level despite an increasing trend. The Met Office REFM output supports fluence levels remaining below the Active period, and this is considered to be good guidance at this stage.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	10	20	30	30
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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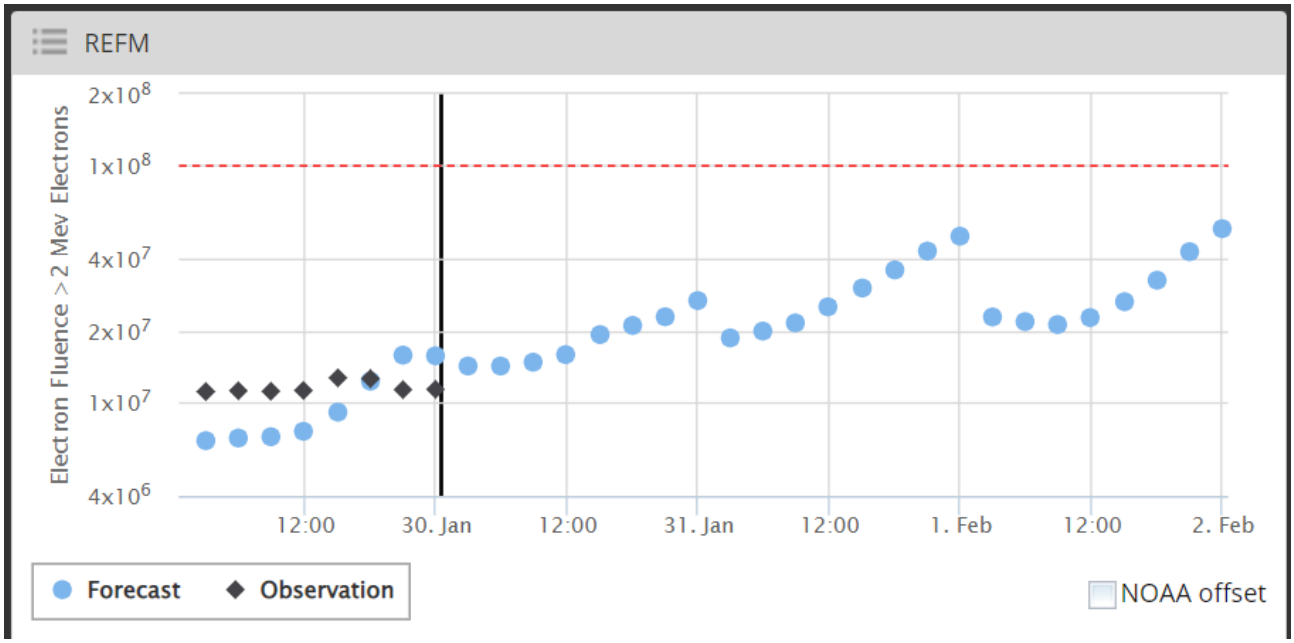
Figure 3: MOSWOC REFM.



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